

to or disclaimer of the subject matter contained therein. Claim 82 is amended to more clearly recite the features therein, to recite that an image formed with the ink has rub-resistance (see page 6 of the specification) and to recite that the encapsulated coloring material is an oil-soluble dye or a non-self-dispersing pigment (see pages 15-18 of the specification). Claims 63, 68-70, 73-78 and 80 are amended to depend from pending claims and so that there is antecedent basis for the elements recited therein. It is submitted that no new matter has been added.

Claims 61-73 and 75-82 were rejected under 35 U.S.C. § 103(a) as allegedly obvious over Lin in view of Tsutsumi et al. Claim 74 was rejected as allegedly obvious over the same two references and further in view of Hotomi et al.

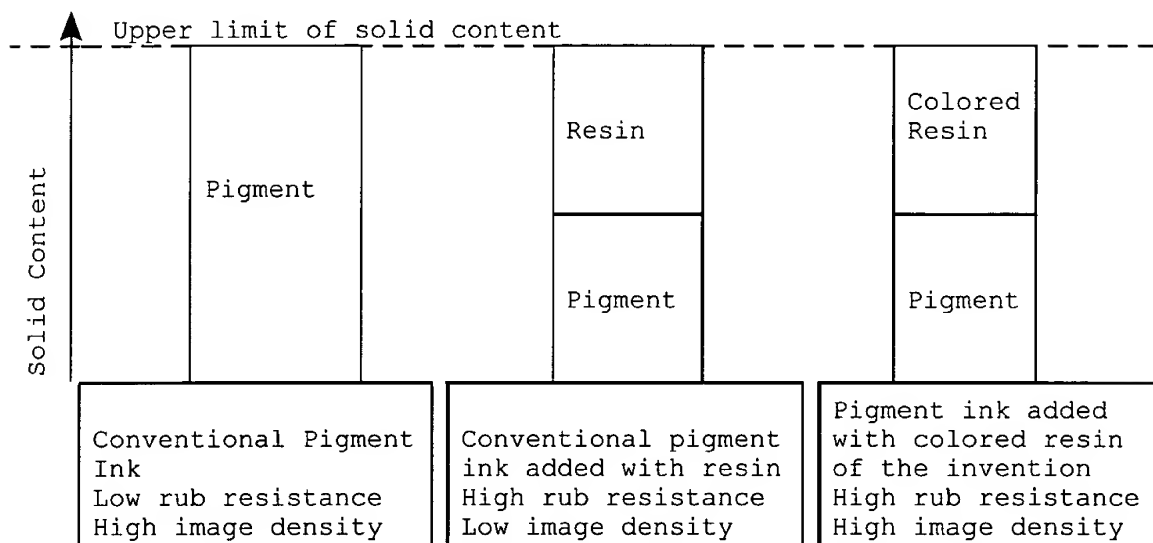
Claims 61-68, 72, 73, 75, 76, 78, 80 and 82 were rejected under 35 U.S.C. § 103(a) as allegedly obvious over Tsutsumi et al. in view of either Johnson et al. or Tsang et al. Claims 69, 70 and 74 were rejected as allegedly obvious over the same combination of references and further in view of Yui et al. and Hotomi et al.

Applicants respectfully disagree with these rejections.

Before addressing the merits of the rejections, Applicants believe it will be helpful to review some features and advantages of the present invention. The present invention

relates to a pigment ink-jet ink that can form ink-jet images having excellent rub-off resistance and image density.

The addition of a resin component to a pigment ink in order to improve the rub-resistance of ink-jet recorded images is already known. However, the solid concentration in an ink-jet ink has an upper limit, if the ink is to maintain its ink-jet properties: that is, if the solid content is too high, it may cause an increase in viscosity, thus making the ink unsuitable for use as an ink-jet ink. Therefore, when a resin component is added to an ink to improve the rub-resistance of the recorded image, the pigment concentration should be reduced to maintain the total solid content so as not to exceed the upper limit (see diagram below.)



The aqueous ink-jet ink of the present invention, as claimed in Claim 82, comprises a self-dispersing pigment and a resin encapsulating a coloring material. The self-dispersing pigment and the resin encapsulating a coloring material are dispersed in an aqueous medium at a solid concentration A. The resin is contained in a sufficient amount to provide rub-resistance to an image produced with the ink. The ink provides an ink-jet recorded image with a certain optical density that is equivalent or substantially equivalent to that produced with an ink containing the self-dispersing pigment as a sole colorant at the solid concentration A. The encapsulated coloring material is an oil-soluble dye or a non-self-dispersing pigment.

Thus, the ink of the invention provides an ink-jet recorded image having the same or almost the same optical density as a conventional pigment ink containing the self-dispersing pigment in an amount equal to the total amount of the self-dispersing pigment plus colored resin in the ink of the invention. In addition, the ink of the invention can provide an image having rub-resistance, but the conventional ink cannot.

This feature is demonstrated by Example 4 and Comparative Example 2 of the specification. Ink D of Example 4 contains a self-dispersing carbon black dispersion at 4 wt% and a colorant-containing resin at 4 wt%. Ink H of Comparative Example 2 contains 8 wt% of the same carbon black but no colorant-

containing resin. As shown in Table 2 (page 58), images formed with Ink D and Ink H have similar image density ("A" rating), but the image formed with Ink D is also excellent in abrasive resistance ("A" rating), in contrast to Ink H ("C" rating). Applicant submits that this effect is clearly due to the addition of the colorant-encapsulating resin. The same is seen in Examples 10-12 and Comparative Example 5 (see Table 4, page 65).

Claim 82 now recites that the colorant encapsulated in the resin is an oil-soluble dye or a non-self-dispersing pigment, which is different from the self-dispersing pigment dispersed in the ink.

Since the ink-jet properties of an ink-jet ink rest on a subtle balance of the components of the ink, it is not predictable, even for one of ordinary skill in the art, as to whether one component of an ink, when incorporated into another ink-jet ink, would provide that ink with the intended property. In Applicant's view, none of the cited references addresses the problem solved by the present invention, that is, when a resin is included in an ink-jet ink to improve water-fastness or rub-resistance of the printed image, the optical density of the image is lowered. Applicant further submits that none of the cited references teaches or suggests an ink-jet ink containing a self-dispersing pigment and a resin encapsulating another coloring

material, nor do they suggest that such an ink can solve the above-mentioned problem.

The Examiner acknowledges that Lin does not disclose the use of a resin encapsulating a coloring material; Tsutsumi et al. is cited for this feature. Applicant notes that Tsutsumi et al. discloses an aqueous ink for ink-jet printing containing a non-water soluble colorant encapsulated into polymer particles, and a specified humectant such as methylglycine. In addition, Tsutsumi et al. states that "not all the colorant present in the aqueous ink needs to be encapsulated into the polymer particles and/or adsorbed on the polymer particles" (column 4, lines 7-9). Thus, in the ink of Tsutsumi et al., the free colorant present in the ink and the colorant that is adsorbed or encapsulated are the same. Applicant submits that Tsutsumi et al. does not teach or suggest using colorants of different types, as recited in Claim 82, in the ink-jet printing ink.

Applicant further submits that the other secondary references, Hotomi et al., Johnson et al., Tsang et al. and Yui et al., do not remedy this deficiency of the Tsutsumi et al. reference. Thus, Applicant concludes that none of the cited art, whether taken singly or in the combinations proposed by the Examiner, teaches or suggests the invention as presently claimed.

In view of the foregoing amendments and remarks, Applicant submits that independent Claim 82 is patentably


distinct over the cited references. Applicant submits that the dependent claims also are patentable for the same reasons as Claim 82, and because they set forth additional aspects of the present invention. Separate and individual consideration of each dependent claim is respectfully requested.

This Amendment After Final Rejection is an earnest attempt to advance prosecution and reduce the number of issues, and is believed to place this application in condition for allowance. Furthermore, Applicant respectfully submits that a full appreciation of these amendments and remarks will not require undue time or effort given the Examiner's familiarity with this application. No new claims have been added. Accordingly, entry of this Amendment Under 37 C.F.R. § 1.116 is respectfully requested.

Applicant submits that the instant application is in condition for allowance. Favorable consideration, and an early Notice of Allowance are requested.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,

  
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Attney Dkt. No.: 03500.013431

VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE CLAIMS

63. (Amended) The ink according to Claim 82 [62], wherein the self-dispersing pigment [carbon black] is a self-dispersing carbon black to the surface of which at least one hydrophilic group is bonded directly or through another atomic group.

68. (Amended) The ink according to Claim 82 [61], further comprising a pigment dispersant.

69. (Amended) The ink according to Claim 63 [68], further comprising a pigment dispersant having [wherein the dispersant has] an anionic hydrophilic group when the hydrophilic group bonded to the surface of the self-dispersing carbon black is anionic.

70. (Amended) The ink according to Claim 63 [68], further comprising a pigment dispersant having [wherein the dispersant has] a cationic hydrophilic group when the hydrophilic group bonded to the surface of the self-dispersing carbon black is cationic.



73. (Amended) The ink according to Claim 82 [61], wherein the pigment and the coloring material have the same color.

74. (Amended) The ink according to Claim 82 [61], wherein the coloring material is encapsulated in a microcapsule made of the resin.

75. (Amended) An ink cartridge, comprising an ink container containing an ink according to Claim 82 [61].

76. (Amended) A recording unit, comprising:  
an ink container containing an ink according to Claim 82 [61],  
a recording head, and  
means for feeding the ink from the ink container to the recording head.

77. (Amended) An ink set comprising a first ink and a second ink in combination, wherein the first ink is an ink according to Claim 82 [61], and each of the first and second inks has a color selected from the group consisting of yellow, magenta, cyan, black, red, green and blue.

78. (Amended) An image recording process, comprising the step of applying an ink according to Claim 82 [61] to a recording medium by an ink-jet process.

80. (Amended) An image recording apparatus, comprising:

an ink container containing an ink according to Claim 82 [61]; and  
an ink-jet head for ejecting the ink.

82. (Amended) An aqueous ink for an ink-jet printing process comprising[:

a colorant comprised of] a self-dispersing pigment and a resin encapsulating a coloring material [in a certain amount], the self-dispersing pigment and the resin encapsulating a coloring material being dispersed in an aqueous medium at a solid concentration A,

the resin being contained in a sufficient amount to provide rub-resistance to an image produced with the ink,

wherein the ink provides an ink jet recorded image with a certain [image whose] optical density that is equivalent or substantially equivalent to that produced with [formed by] an ink containing [comprising] the self-dispersing pigment as a sole colorant at the solid concentration A, and wherein the

encapsulated coloring material is an oil-soluble dye or a non-  
self-dispersing pigment [in the certain amount].

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